

Subject card

Subject name and code	Linear Algebra II, PG_00155251						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		5.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Błażej Szepietowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		5.0		60.0	125
Subject objectives	The aim of the course is to familiarize students with the basic methods and theorems of linear algebra and with selected concepts of general algebra.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MMiADL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	is ready to acknowledge the limitations of their knowledge and is willing to pursue further mathematical education	[SK1] oral statement/conversation/discussion
	[MMiADL3_W07] knows and understands the construction of mathematical theories, can use mathematical formalism to build and analyse simple mathematical models in other fields of science	knows and understands the role and importance of axioms in the construction of mathematical theories	[SW4] test/exam - oral or written
	[MMiADL3_K04] is ready to understand and appreciate the importance of intellectual honesty in own and other people's actions; is ready to act ethically	is ready to appreciate and respect intellectual honesty and to act ethically in their own work and when assessing the work of others	[SK8] observation of student's independent or team work
	[MMiADL3_K09] is ready to critically evaluate arguments, find gaps in reasoning, and constructively criticise other people's reasoning	is ready to critically evaluate arguments, identify gaps in reasoning, and provide constructive criticism in a respectful and constructive manner	[SK8] observation of student's independent or team work
	[MMiADL3_W08] knows and understands well the role and importance of proof in mathematics, as well as the concept of the significance of assumptions	knows and understands the role and importance of mathematical proof, can indicate which assumptions are crucial for theorems	[SW4] test/exam - oral or written
	[MMiADL3_U03] correctly uses the concepts of linear algebra and geometry, is able - at a simple and medium level of difficulty - to apply the theorems and methods of these fields, and is able to interpret the results obtained; correctly uses the concepts of general algebra	is able to efficiently apply the concepts of linear algebra and Euclidean geometry, selecting appropriate methods, and interpret the obtained results; is also able to efficiently use the basic concepts of general algebra	[SU4] test/exam - oral or written
	[MMiADL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning	is ready to ask precise and relevant questions in order to deepen their understanding of the subject or fill gaps in their reasoning	[SK1] oral statement/conversation/discussion
	[MMiADL3_W01] knows the basic concepts, methods and theorems of mathematical logic and set theory	knows the basic concepts, methods and theorems of mathematical logic and set theory that are used when formulating theorems and carrying out proofs in linear algebra	[SW4] test/exam - oral or written
	[MMiADL3_U01] correctly uses the learned concepts of mathematical logic and set theory	is able to correctly use the concepts of mathematical logic and set theory when formulating and proving theorems and solving theoretical and practical problems in linear algebra	[SU4] test/exam - oral or written
	[MMiADL3_U07] can comprehensively, in speech and in writing, formulate definitions and theorems and present correct mathematical reasoning regarding the issues learned	is able to formulate definitions and theorems concerning the issues learned in an understandable manner, both orally and in writing, and to carry out correct mathematical reasoning based on the use of linear algebra methods.	[SU4] test/exam - oral or written
	[MMiADL3_K06] is ready to formulate opinions on basic mathematical issues	is ready to formulate opinions on the mathematical issues learned	[SK1] oral statement/conversation/discussion
	[MMiADL3_W03] knows the basic concepts, methods and theorems of linear algebra and analytical geometry as well as basic examples both illustrating specific concepts in these fields, and allowing to refute incorrect hypotheses or unauthorized reasoning; knows the selected concepts of general algebra	knows and understands the basic concepts, methods and theorems of linear and general algebra within the scope of the curriculum, as well as the basic computational methods used in linear algebra.	[SW4] test/exam - oral or written
	[MMiADL3_U08] is able to plan a way to solve a given problem and make a correct record of this solution, providing accurate and precise justifications for the correctness of their reasoning	is able to independently plan a way to solve a given mathematical problem, as well as present a full, correct record of this solution, providing precise and transparent justification for the methods and steps used	[SU4] test/exam - oral or written

Subject contents	1. Linear mappings. Examples of linear maps, kernel, image, structure of linear maps. Matrices of linear maps. Transition matrices. 2. Eigenvalues and eigenvectors. Characteristic polynomial. 3. Bilinear mappings and scalar products. Symmetrical bilinear mappings and their associated quadratic forms. Form matrices. Determinacy of the quadratic form. 4. Elements of geometry in Euclidean spaces - angle between vectors, orthogonality, norm, distance. Euclidean, normed, metric spaces. Gram-Schmidt orthogonalization. 5. Basics of general algebra: binary operation on a set, associativity, commutativity, neutral and inverse elements. 6. Groups. Definitions and examples, order of an element, cyclic groups, subgroup, order of a subgroup, Lagrange's theorem. 7. English nomenclature of the course		
Prerequisites and co-requisites	Linear algebra I		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	observation of student's attitude	51.0%	0.0%
	egzamin	51.0%	40.0%
	tests	51.0%	30.0%
	short tests	51.0%	30.0%
Recommended reading	Basic literature	J. Topp, Algebra liniowa, Wyd. PG, Gdańsk 2005 J. Rutkowski, Algebra liniowa w zadaniach, PWN , 2008.	
	Supplementary literature	B. Gleichgewicht, Algebra, Oficyna Wydawnicza GiS, Wrocław 2002; A. Białynicki-Birula, Algebra, PWN Warszawa 2014;	
	eResources addresses		
Example issues/ example questions/ tasks being completed	- Determine the matrix of a given linear transformation in the specified bases. - Determine the kernel and image of a given linear transformation. - Determine the eigenvalues and eigenvectors of a given linear transformation. - Check whether a given quadratic form is positively or negatively definite. - Perform orthogonalization of a given basis. - Check whether a given set with an operation forms a group. - Prove that a linear transformation is bijective if and only if its kernel is trivial. - Prove that eigenvectors corresponding to different eigenvalues are linearly independent. - Formulate and prove the orthogonalization theorem.		
Work placement	Not applicable		

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